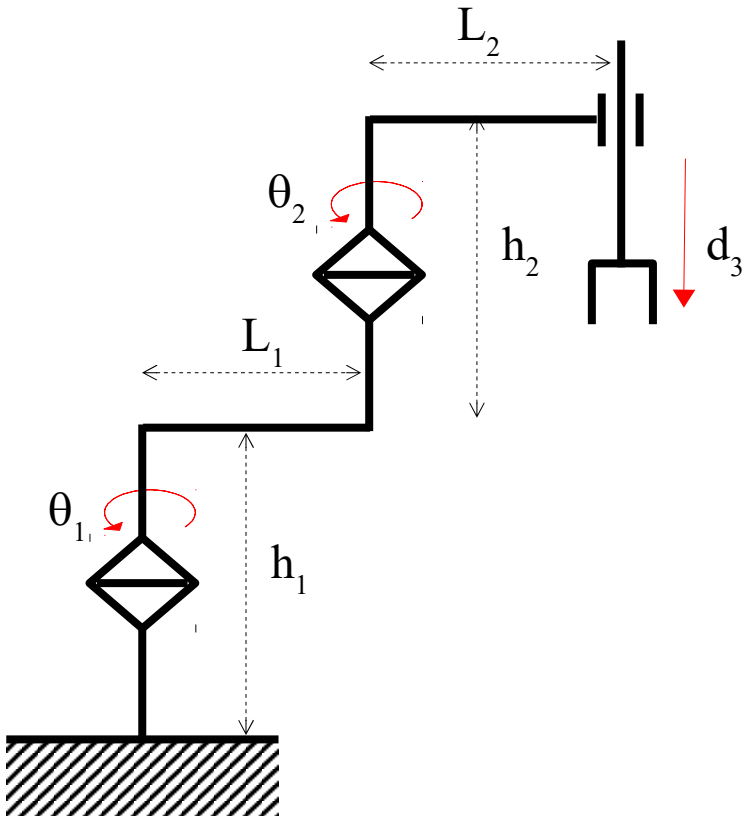
CINEMÁTICA DIRETA

EXEMPLO DE CINEMÁTICA DIRETA
BRAÇO COM JUNTA PRISMÁTICA

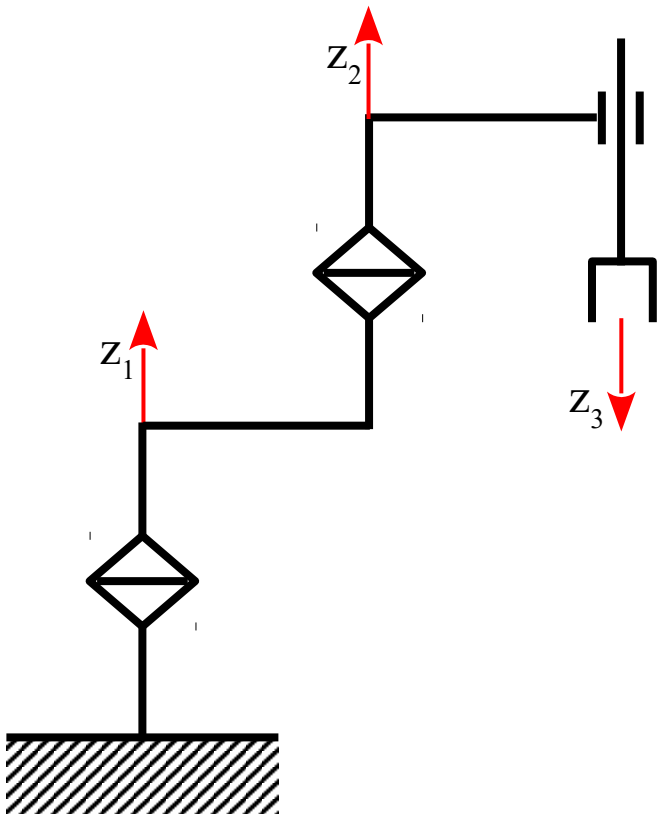
Exemplo de Cinemática Direta
Braço Manipulador SCARA

Considere o manipulador robótico abaixo. Determine a cinemática direta do braço.

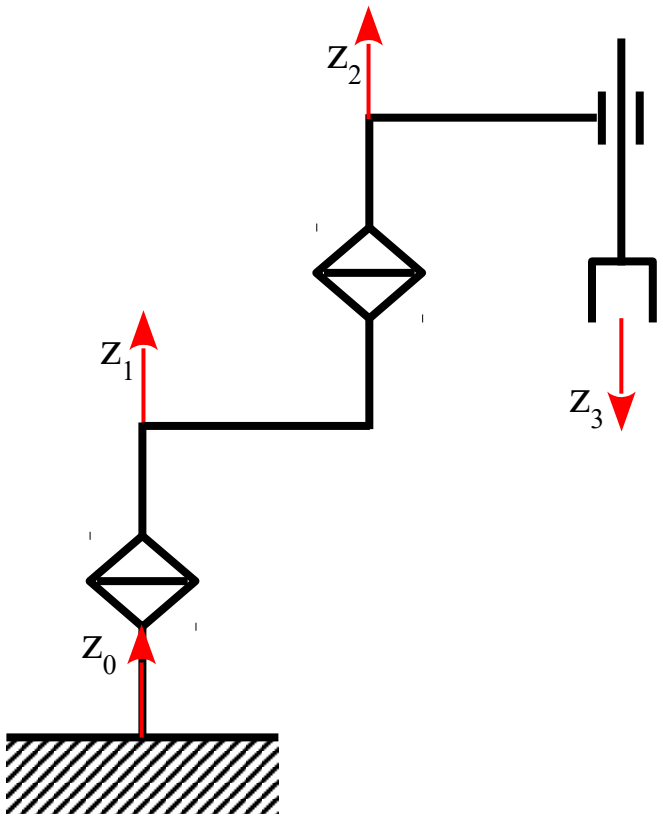
Diagrama Esquemático



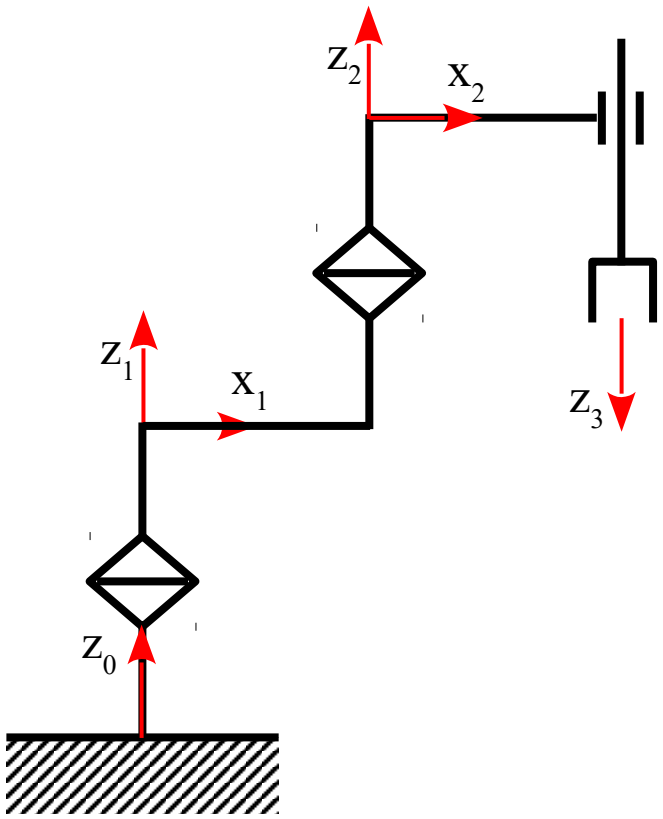
Atribuindo referenciais aos elos – Eixos z



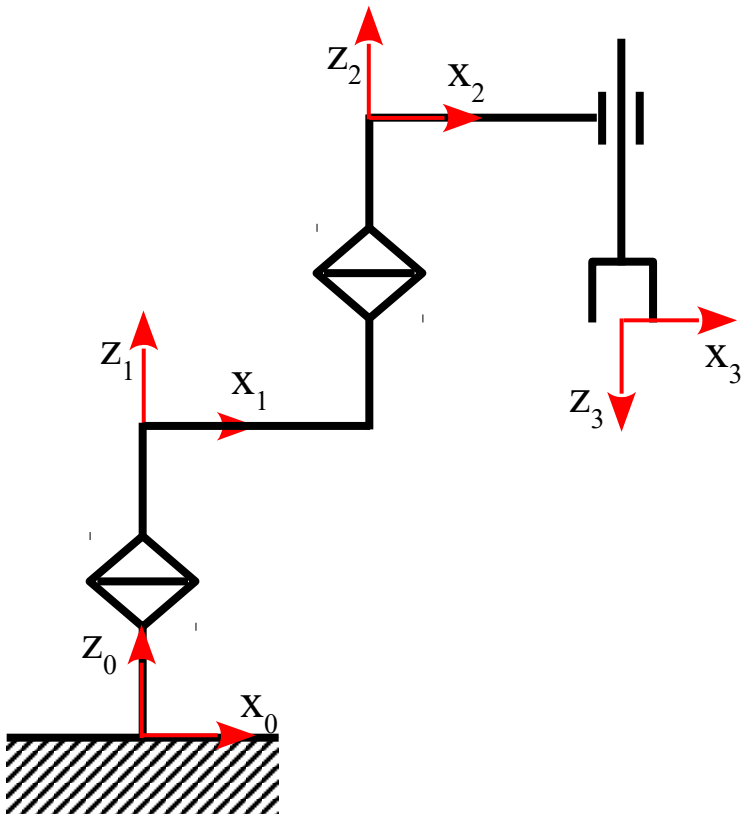
Atribuindo referenciais aos elos - Base



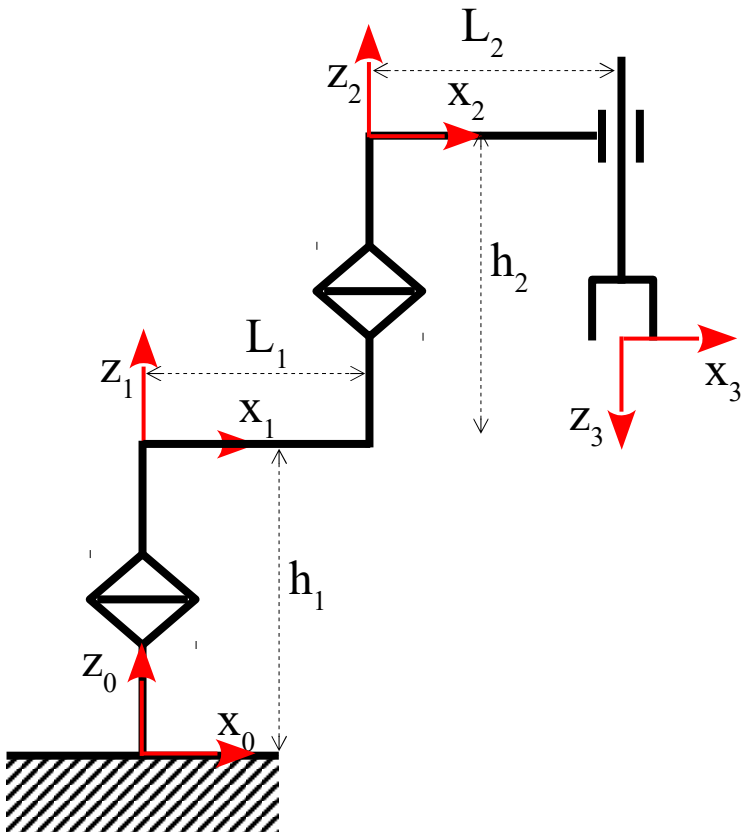
Atribuindo referenciais aos elos – Eixos x



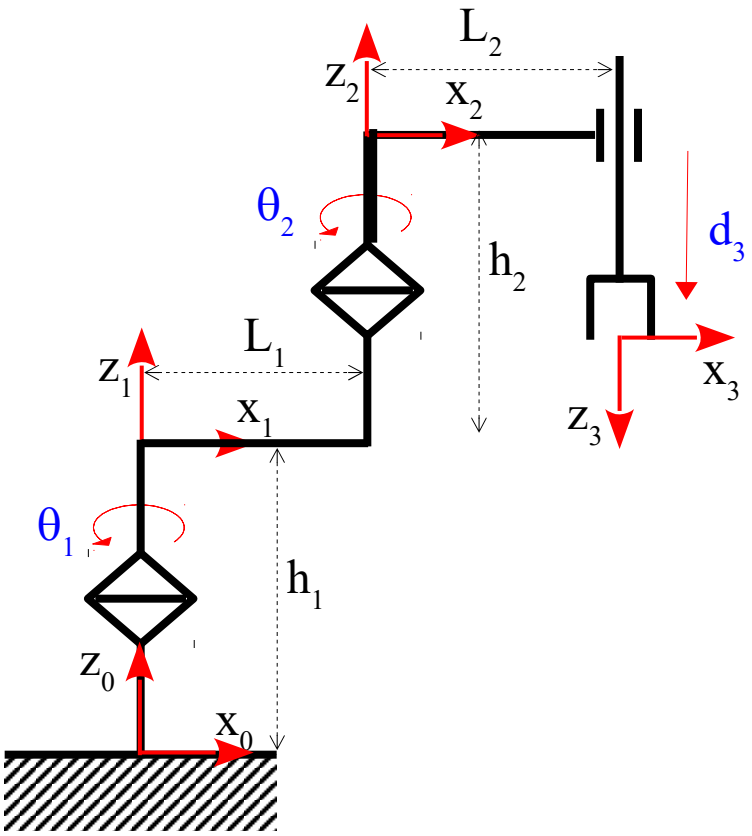
Atribuindo referenciais aos elos – Extremidades



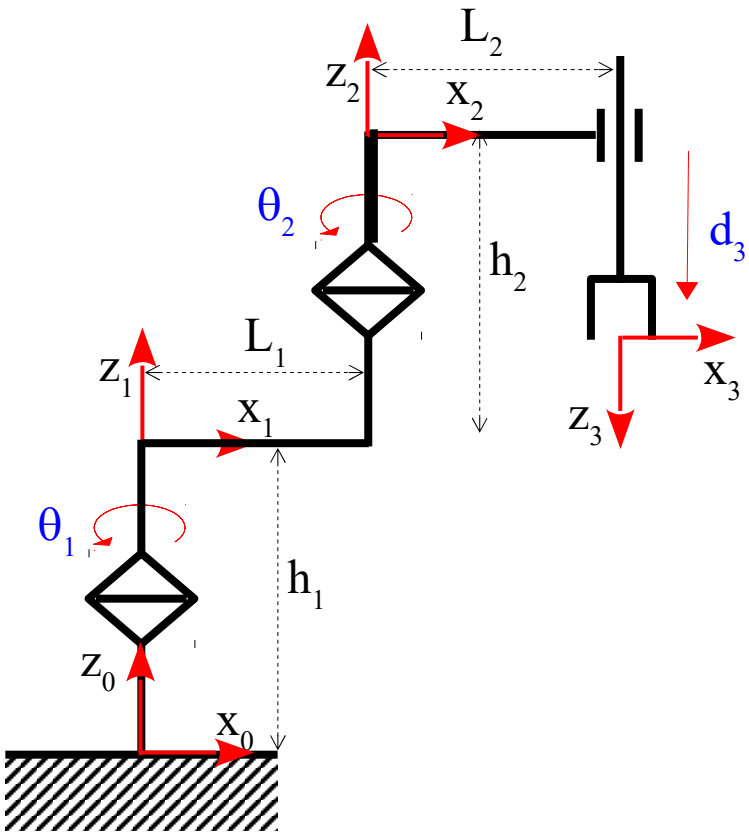
Parâmetros Denavit - Hartenberg



Parâmetros Denavit – Hartenberg: variáveis de junta



Parâmetros Denavit – Hartenberg



i	a_{i-1}	α_{i-1}	d_i	θ_i
1	0	0º	h_1	θ_1
2	L_1	0º	h_2	θ_2
3	L_2	180º	d_3	0º

Transformações de Elo

i	a_{i-1}	α_{i-1}	d_i	θ_i
1	0	0^o	h_1	θ_1
2	L_1	0^o	h_2	θ_2
3	L_2	180^o	d_3	0^o

$$^0T_1 = \begin{bmatrix} c_1 & -s_1 & 0 & 0 \\ s_1 & c_1 & 0 & 0 \\ 0 & 0 & 1 & h_1 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad ^1T_2 = \begin{bmatrix} c_2 & -s_2 & 0 & L_1 \\ s_2 & c_2 & 0 & 0 \\ 0 & 0 & 1 & h_2 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad ^2T_3 = \begin{bmatrix} 1 & 0 & 0 & L_2 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & -d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Concatenando as Transformações de Elo

$$
{}^{0}T_{2} = {}^{0}T_{1} . {}^{1}T_{2} = \begin{bmatrix} c_1 & -s_1 & 0 & 0 \\ s_1 & c_1 & 0 & 0 \\ 0 & 0 & 1 & h_1 \\ 0 & 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} c_2 & -s_2 & 0 & L_1 \\ s_2 & c_2 & 0 & 0 \\ 0 & 0 & 1 & h_2 \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

$$
\Rightarrow {}^{0}T_{2} = \begin{bmatrix} c_{12} & -s_{12} & 0 & c_1 L_1 \\ s_{12} & c_{12} & 0 & s_1 L_1 \\ 0 & 0 & 1 & (h_1 + h_2) \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

Concatenando as Transformações de Elo

$$ {}^{0}T_{3} = {}^{0}T_{2} . {}^{2}T_{3} = \begin{bmatrix} c_{12} & -s_{12} & 0 & c_1 L_1 \\ s_{12} & c_{12} & 0 & s_1 L_1 \\ 0 & 0 & 1 & (h_1 + h_2) \\ 0 & 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} 1 & 0 & 0 & L_2 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & -d_3 \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

$$ \Rightarrow {}^{0}T_{3} = \begin{bmatrix} c_{12} & s_{12} & 0 & (c_1 L_1 + c_{12} L_2) \\ s_{12} & -c_{12} & 0 & (s_1 L_1 + s_{12} L_2) \\ 0 & 0 & -1 & (h_1 + h_2 - d_3) \\ 0 & 0 & 0 & 1 \end{bmatrix} $$

Função de Cinemática Direta

$$
{}^{0}T_{3} = \begin{bmatrix} c_{12} & s_{12} & 0 & (c_1 L_1 + c_{12} L_2) \\ s_{12} & -c_{12} & 0 & (s_1 L_1 + s_{12} L_2) \\ 0 & 0 & -1 & (h_1 + h_2 - d_3) \\ 0 & 0 & 0 & 1 \end{bmatrix}
$$

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